

REMARKS

By the present amendment, claims 3 and 6 are pending in the application.

Restriction Requirement

Claims 1-2 and 4-5 were withdrawn from consideration as being drawn to non-elected inventions as the result of a restriction requirement.

In response to the restriction requirement, claims 1-2 and 4-5 have been canceled by the present amendment without prejudice to the filing of a divisional application(s) directed to claims 1-2 and 4-5.

Claim Amendments

Support for the amendments to independent claims 3 and 6 may be found in the specification, e.g., page 9, lines 8-15 and page 1, line 36 to page 2, line 2. This will hereinafter be discussed in detail in the response to the rejection under 35 U.S.C. §112, first paragraph.

§112, ¶1

Claims 3 and 6 were rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement. The Office Action objected to the claim limitation “a left-right swivelling component of roll gap of said rolling mill”.

In response to this rejection, claims 3 and 6 have been amended by the present amendment for purposes of improving the clarity of claims 3 and 6.

The following is an explanation of the meaning of the original limitation “a left-right swivelling component of roll gap of said rolling mill”

As disclosed at page 9, lines 8-15 of the specification:

It becomes possible to prevent, in advance, the occurrence of the camber by controlling the roll gap in the direction that eliminates the left-right difference to the rolled material speed on the exit

side so detected, that is, by reducing the roll gap on the side at which the rolled material speed on the exit side is low and increasing the roll gap on the high speed side.

Thus, the limitation “the left-right swivelling component of roll gap of said rolling mill” means a difference of roll gap between the left and right of the rolling mill.

Further, as disclosed in the specification at page 1, line 36 to page 2, line 2:

a chamber control technology that controls a left-right difference of roll gap on the rolling mill, that is, reduction leveling

Thus, the limitation “controlling ... the left-right swivelling component control quantity of the roll gap” means controlling a left-right difference of roll gap of the rolling mill, that is, reduction leveling.

The following explanations are set forth for reference.

i) “Reducing” the roll gap is the operation of adjusting the hydraulic screw down cylinder positions or screw down positions to reduce the roll gap, while “increasing” is the reverse operation. This is clearly an operation necessarily required in the case of a rolling mill as can be understood by a person skilled in the art without requiring any special explanation.

ii) Note that the method of “control”, as described at page 15, lines 29 to 33, is made possible by “the control quantity is calculated by PID calculation that takes a proportional (P) gain, an integration (I) gain, and a differentiation (D) gain into consideration on the basis of F_p^{df} , for example” and, as described at page 14, line 18 to 23, “a left-right difference is applied to the control instruction value of the rolling load to indirectly control the left-right swivelling component of the roll gap in the case of the rolling operation where the control object is to set the rolling load to a predetermined value as in skin pass rolling”.

iii) The term “roll gap control” means independent control of the left-right reduction mechanisms. This is known to a person skilled in the art.

iv) The “roll gap” is the gap between the bottom surface of a top work roll and the top surface of a bottom work roll at the time of rolling and means not only the gap at the centers of the lengths of the top and bottom work rolls, but also the distribution of gaps in the length directions of the top and bottom rolls.

In view of the present amendment and the foregoing remarks, it is respectfully requested that the rejection under 35 U.S.C. §112, first paragraph, be withdrawn.

§102

Claims 3 and 6 were rejected under 35 U.S.C. §102(b) as being unpatentable over Japan No. 06-262207 to Ogawa et al.

This rejection is respectfully traversed.

The Present Invention

The present inventors discovered that left-right swivelling (i.e., left-right difference, asymmetry or unbalance) of the rolling direction force acting on the rolled material and the rolling direction force action on the rolling mill through the rolled material manifests itself as the left-right swivelling (i.e., left-right difference, asymmetry or unbalance) of the roll gap.

On the basis of this discovery, the rolling method for metal material comprising, measuring left-right swivelling (i.e., left-right difference, asymmetry or unbalance) of rolling direction force acting on the rolled material and the rolling direction force acting on the rolling mill through the rolled material, calculating the left-right balance

of these rolling direction forces, controlling the left-right swivelling components (i.e., left-right difference, asymmetry or unbalance) of the roll gap based on the unbalanced components, comprises the present invention.

According to the present invention, since a camber which occurs owing to various causes is accurately measured and controlled without time delay, a flat-rolled material not having or having extremely little camber can be obtained.

Japan No. 06-262207 ("JP '207)

JP '207 discloses a tandem rolling mill used for hot rolling or cold rolling and arranging at the last stand thereof a rolling mill characterized in that either one or both of upper and lower roll assemblies have a mechanism for supporting a work roll, by split back up rolls split into at least three segments in axial direction, with the split backup roll group having a construction for supporting both a vertical direction load and a rolling direction load acting on the contacting work roll and each of the split backup rolls independently having a load measuring device.

The purpose of JP '207 is to provide a tandem rolling mill capable of reducing the generation of a plate unsuitable in plate crown or shape as a result of rolling.

Although the construction of the rolling mill of JP '207 is almost the same as claim 3 and 6, the controlling method of rolling of JP '207 is greatly different from that of present invention.

Paragraph [0020] of JP '207 discloses that the plate is rolled using a configuration feed back control which, based on the output of the detection device (load cell) of each split backup rolls, controls the rolling amount of a screw down device of the backup rolls so that the rolling load distribution of each split backup rolls turns into a targeted distribution of load.

JP '207 aims to control the screw-down position of each of split backup rolls during rolling in order to obtain a targeted plate configuration.

However, in JP '207, the control of the imaginary rolling direction forces F_R^W , F_R^D , which are the rolling direction forces acting between the rolled material and the work roll, is evaluated at the work roll chock position on operator side and the driving side. The present invention is not conducted according to the method of JP '207.

In JP '207, when the material condition is changed (for example distribution of deformation resistant and/or distribution of plate crown are changed) in the preset load distribution, the camber cannot be controlled by the method disclosed in JP '207.

As explained above, JP '207 does not disclose or suggest the rolling method for metal material comprising, measuring left-right swivelling (i.e., left-right difference) of rolling direction force acting on the rolled material and the rolling direction force acting on the rolling mill through the rolled material, calculating the left-right balance of these rolling direction forces, and controlling the left-right swivelling components (i.e., left-right difference) of a roll gap based on the unbalanced components, all in accordance with the present invention.

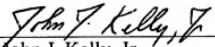
It is therefore submitted that claims 3 and 6 are patentable over Japan No. 06-262207 to Ogawa et al.

CONCLUSION

It is submitted that in view of the present amendment and foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application, as amended, be allowed and passed for issue.

Respectfully submitted,

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Dated: April 5, 2007

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